Determinants

A determinant of order 2 is arrangements of 2^2 i.e. 4 number (or expressions) in the form of a square along two horizontal lines called rows and along two vertical lines called columns and these numbers are enclosed within two vertical lines.

$$\begin{vmatrix} 3 & 2 \\ 1 & 4 \end{vmatrix}$$

A determinant of order 3 is arrangements of 3^2 i.e. 9 number (or expressions) in the form of a square along three horizontal lines called rows and along three vertical lines called columns and these numbers are enclosed within three vertical lines.

$$\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$$

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Evaluate determinants $\begin{vmatrix} -3 & 1 \\ 5 & 6 \end{vmatrix}$

$$|A| = \begin{vmatrix} -3 & 1 \\ 5 & 6 \end{vmatrix}$$

$$-18 - 5 = -23 \quad \text{Ans}$$

Q-2

$$|A| = \begin{vmatrix} 4 & 1 \\ 6 & 8 \end{vmatrix} = 32 - 6 = 26$$

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Evaluate $\begin{vmatrix} 3 & -7 & 13 \\ -5 & 0 & 0 \\ 0 & 11 & -2 \end{vmatrix}$

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$$

$a_{11} = 1+1 = 2$

even = +
odd = −

$$= 3\begin{vmatrix} 0 & 0 \\ 11 & -2 \end{vmatrix} - 7\begin{vmatrix} -5 & 0 \\ 0 & -2 \end{vmatrix} + 13\begin{vmatrix} -5 & 0 \\ 0 & 11 \end{vmatrix}$$

$$= 3(0-0) - 7(10-0) + 13(-55-0)$$

$$= 0 - 70 - 715$$

$$= -785$$

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$|A| =$ Evaluate $\begin{vmatrix} 2 & 3 & -5 \\ 7 & 1 & -2 \\ -3 & 4 & 1 \end{vmatrix}$

$$|A| = 2\begin{vmatrix} 1 & -2 \\ 4 & 1 \end{vmatrix} - 3\begin{vmatrix} 7 & -2 \\ -3 & 1 \end{vmatrix} - 5\begin{vmatrix} 7 & 1 \\ -3 & 4 \end{vmatrix}$$

$$= 2(1+8) - 3(7-6) - 5(28-3)$$

$$= 2 \times 9 - 3(1) - 5(25)$$

$$= 18 - 3 - 75$$

$$= 15 - 75 = -60 \text{ Ans}$$

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Find the value of x if

i) $\begin{vmatrix} 2x+5 & 3 \\ 5x+2 & 9 \end{vmatrix} = 0$

$$9(2x+5) - 3(5x+2) = 0$$

$$18x + 45 - 15x - 6 = 0$$

$$3x + 39 = 0$$

$$3x = -39$$

$$x = \frac{-39}{3} = -13 \quad \text{Ans}$$

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If $\begin{vmatrix} x+1 & x-1 \\ x-3 & x+2 \end{vmatrix} = \begin{vmatrix} 4 & -1 \\ 1 & 3 \end{vmatrix}$, *then write the value of* x

$$(x+1)(x+2) - (x-3)(x-1) = 12+1$$

$$x^2 + 2x + x + 2 - [x^2 - x - 3x + 3] = 13$$

$$x^2 + 3x + 2 - x^2 + 4x - 3 = 13$$

$$7x - 1 = 13$$

$$7x = 13 + 1 = 14$$

$$7x = 14$$

$$x = \frac{14}{7}$$

$$\boxed{x = 2}$$

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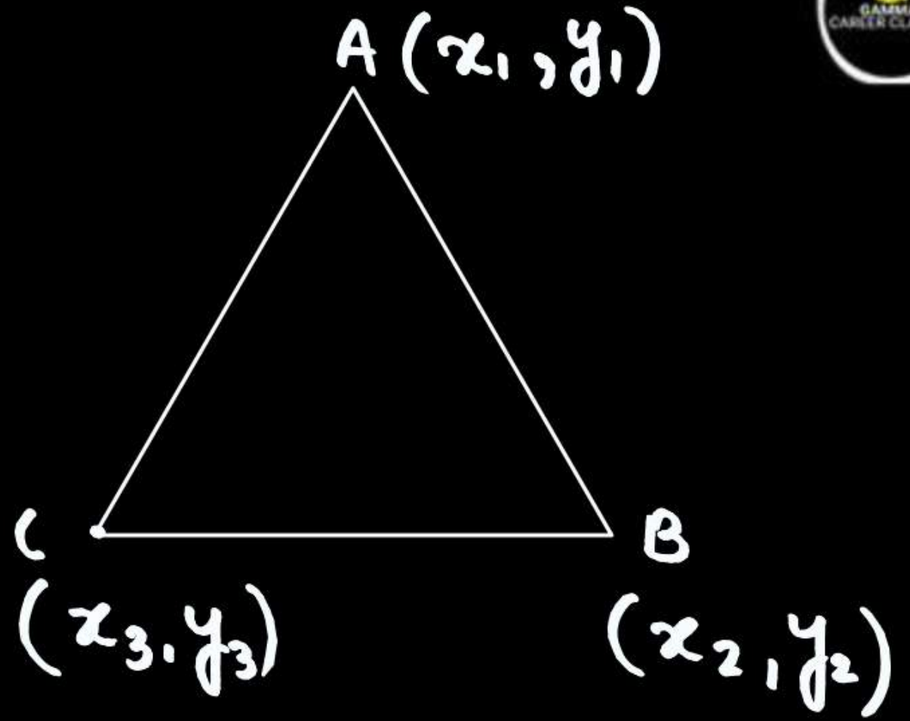
Area of a Triangle $= \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$

$\Delta = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$

Positive



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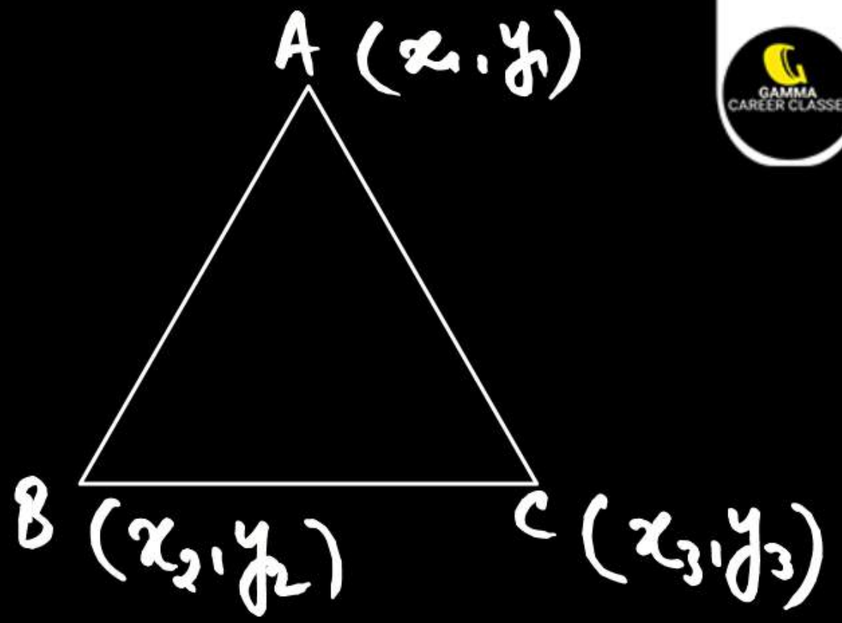
$A(3,8)$ $B(-4,2)$ $C(5,1)$

x_1 y_1 x_2 y_2 x_3 y_3

Area of a triangle $= \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$



$$= \frac{1}{2}\begin{vmatrix} 3 & 8 & 1 \\ -4 & 2 & 1 \\ 5 & 1 & 1 \end{vmatrix}$$

$$= \frac{1}{2}\left[3(2-1)-8(-4-5)+1(-4-10)\right] \text{ Sq Unit}$$

$$= \frac{1}{2}\left[3-8\times-9-14\right] = \frac{1}{2}\left[3+72-14\right] = \frac{1}{2}\times 64 = 32$$

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Minors and Cofactors

$$\Delta = \begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$$

$$M_{11} = \begin{vmatrix} 5 & 6 \\ 8 & 9 \end{vmatrix} = 45 - 48 = -3$$

$$M_{12} = \begin{vmatrix} 4 & 6 \\ 7 & 9 \end{vmatrix} = 36 - 42 = -6$$

$$M_{13} = \begin{vmatrix} 4 & 5 \\ 7 & 8 \end{vmatrix} = 32 - 35 = -3$$

:

Cofactors.

$$A_{ij} = (-1)^{i+j} M_{ij}$$

$$A_{11} = (-1)^{1+1} (-3)$$

$$A_{11} = 1 \times -3 = -3$$

$$A_{12} = (-1)^{1+2} (-6)$$

$$= -1(-6) = 6 \text{ Ans}$$

$$A_{13} = (-1)^4 \times -3 = -3 \text{ Ans}$$

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